

NASA ADVISORY COUNCIL

HELIOPHYSICS SUBCOMMITTEE

July 2-3, 2012

NASA Headquarters
Washington, D.C.

MEETING MINUTES

Maura Hagan, Chair

Jeffrey Newmark, Executive Secretary

NAC Heliophysics Meeting Minutes, July 2-3, 2012

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Monday July 2, 2012

Introduction

Dr. Maura Hagan, newly appointed Chair of the Heliophysics Subcommittee (HPS), opened the meeting and led introductions around the table, and noted two new members, Drs. Mihir Desai and Jeffrey Hughes.

Overview of the Heliophysics Division Status (HPD)

Dr. Barbara Giles, Director of the Heliophysics Division (HPD), provided a status of the Division as the community looks forward to an important year, anticipating the release of the new Decadal Survey. The HPD program is divided into four budget lines: Solar Terrestrial Probes (STP), Living with a Star (LWS), Explorer and Research programs. Five missions in the calendar year (CY) CY12-18 period are in development, of which two are Flagship missions. The Technology Testbed program, the Balloon program, and a range of suborbital experiments are also being supported, representing a testimony to the creativity of the community, and Dr. Giles' predecessor, Dick Fisher. Within the STP program is the Magnetospheric Multiscale (MMS) mission, which is committed to a launch date (LD) by 2015, but is on track to launch October 2014. The Radiation Belt Storm Probes (RBSP) mission is committed to a September 2012 launch date, but its internal LD is currently August 23, 2012; the spacecraft is at Kennedy Space Center (KSC); progress is going well and the mission is under budget thus far. The Solar Orbiter (SO) collaboration with the European Space Agency (ESA) is under way. Solar Probe Plus (SPP) is not yet confirmed, and is in phase B at present. Solar Orbiter will come up for confirmation in December of this year, and SPP a year later. In the Explorers program, the Interface Region Imaging Spectrograph (IRIS) mission is on track to launch in late January 2013. Dr. Giles emphasized that HPD manages the entire suborbital rocket program for NASA, which includes some missions for the Astrophysics Division (APD). Conversely, the Balloon program is managed by APD. Future Explorers for HPD include 6 under study: 3 full missions and 3 Missions of Opportunity (MoOs). HPD will endeavor to select one of each. Concept study reports are due at the end of September, and the Division hopes to make selections in early Spring 2013.

HPD is using these assets to fulfill three science objectives for the FY12-13 budgets: understanding fundamental physical processes of the space environment; understanding the effects of solar variability and planetary magnetic fields; and maximizing the safety and productivity of human and robotic exploration in space. HPD will be reporting on its performance against these objectives for the Program Assessment Report (PAR).

There are 17 HPD missions currently in flight, spanning the 4 budget lines. The Solar TERrestrial Relations Observatory (STEREO) mission and Hinode are in STP; the Solar Dynamic Orbiter (SDO) is under LWS. There are also various Explorers, and other missions in the Research program. Maintaining these missions within the present budget constraints will be quite difficult. It will be of considerable importance to note the outcome of the Senior Review this year, evaluating trades and choices within the

budget parameters. NASA is also newly engaged in providing a real-time space weather utility, and is making data available to the National Oceanic and Atmospheric Administration (NOAA), adding beacons to spacecraft, and making labor available to keep data and models flowing; this effort is also a pressure on the HPD budget. The White House Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) are supporting this push for space weather; RBSP contains some assets that will still need to be absorbed into an operational model for such purposes. Dr. Karel Schrijver asked if there were any hopes for partnerships with the Department of Defense (DoD), the Department of Energy (DOE), and other federal departments interested in this data, and if so, how HPS might help make it clear that NASA needs more support if it is to provide this data to partners. Dr. Giles indicated that there is a move afoot in the government towards greater support, including a new group that includes the Federal Emergency Management Agency (FEMA) and the Federal Aviation Administration (FAA), which meets under OSTP. NASA has had two meetings with this entity thus far and is taking things forward. NASA has done as much it can possibly do without compromising its research programs. There is a cost associated with putting beacons on spacecraft, but in terms of ground support, NASA has not spent large amounts of money. Every relevant federal agency is trying to leverage assets for this purpose. Dr. Jeff Newmark noted that under the National Space Weather Program, STEREO has received money from DoD as a result of highlighting this need. MMS does not have a beacon for space weather data, having been de-scoped, disappointingly.

Budget

There are 86 missions currently operating within the Science Mission Directorate (SMD), and 98 spacecraft. HPD has a relatively large number of missions, and is well represented in the upcoming launch queue. Major accomplishments include the ability to image solar flares in three dimensions and track solar storms from Sun to Earth, the discovery that Earth's atmosphere extends into space farther than previously thought, major discoveries through the Interstellar Boundary Explorer (IBEX) and the two Voyager spacecraft, etc. The FY13 budget is fully capable of supporting RBSP, IRIS, MMS, the SO collaboration, and SPP, if these missions stay within their commitments. HPD also intends to support the next Explorer missions, aiming to fund one full mission and one MoO, as well as the follow-on Explorer solicitation (in 2015). HPD has also made a modest investment in a new Sounding Rocket motor, to replace the problematic Black Brant motor. While HPD is capable of supporting the 17 missions currently in operation, and maintaining the Research, Suborbital and Technology programs, there is very little funding buffer.

In response to a question about the DSCOVR mission, Dr. Giles noted that it is now in the Joint Satellite Projects Division, and DSCOVR has been placed in the NOAA budget. There is no line for the mission in NASA at this time; DSCOVR is treated as a reimbursable project for the Joint Satellite program. NASA has also been maintaining the Solar and Heliophysics Observatory (SOHO) with ESA for the purpose of using the coronagraph, providing bare-bones data collection support at this time. SOHO will be further evaluated during the Senior Review.

Dr. Giles reviewed the funded and leveraged activities within HPD, including non-budget line items for which the division is responsible, such as technology development for future missions, strategic planning.

Within the budget lines, there is a small amount of leeway for funding decisions, but Congressional approval is needed for large missions.

Of note also is the imminent release of the HP Decadal Survey. Its completion date is anticipated for mid-August 2012. An informational website is located at:
[sites.nationalacademies.org/SSB/CurrentProjects/SSB 056864](http://sites.nationalacademies.org/SSB/CurrentProjects/SSB%2056864).

Final edits are in progress. The National Research Council (NRC), the National Science Foundation (NSF), NOAA, and NASA are planning roll-out activities using a multiple Town Hall format for the release of the document.

Heliophysics Flight Program Status

Dr. Vicki Elsbernd presented a status of the HPD Flight Program. Three major launches are scheduled for this year, including BARREL, a multi-Balloon mission intended to augment RBSP. LWS is uniformly Green in status; this is welcome news concerning RBSP, which was shipped to KSC on May 1. A Mission Readiness Review for RBSP is scheduled for July 20. NASA has just signed a joint program implementation plan with ESA for SO. Currently mission planners are analyzing planetary launch windows for fly-by opportunities, as well as back-up launch periods.

Space Environment Testbed (SET-1) is scheduled for 2014; it will be piggybacking on the launch of a Defense Meteorological Satellite Program (DMSP), a US Air Force weather satellite. Recently, NASA representatives attended a ribbon-cutting at the Korean Astronomy Institute (KASI), marking the construction of a 7-meter antenna, signifying the first agreement between South Korea and NASA HQ; the KASI antenna will aid in collecting RBSP space weather beacon data. Under STP, MMS has some yellow grades due to thermal vacuum testing schedule conflicts with the James Webb Space Telescope (JWST), which has caused additional cost to the MMS project. HPD is holding Yellow grades for MMS until the completion of a System Integration Review. HPD anticipates a decision to release UFE (reserve) funds in September/October 2012 to absorb schedule costs. The Division is also addressing some minor technical issues. MMS retains an internal launch readiness date (LRD) of October 2014, which is still months from an external LRD of March 2015, thus well within the original margin. Significant accomplishments for MMS include the start of integration of 100 instruments across 4 spacecraft, a complex undertaking. The integration of the first spacecraft bus and first instrument suite is ongoing and is making good progress.

The Explorer program just completed a Key Decision Point (KDP-D) for IRIS, and received a very positive report from the Standing Review Board (SRB). The IRIS LRD has been moved from Dec 1, 2012 to Jan 22, 2013. An additional \$13.1M UFE has been approved to the project, which is also dealing with some schedule delays, as well as issues with S-band and X-band boxes. The schedule is held as Yellow but the launch date still looks good. In Operating Missions, everything is Green but IBEX, due to a safe mode event in one of the instruments; a root cause analysis is ongoing. The Aeronomy of Ice in the Mesosphere (AIM) mission achieved bitlock after 172 days, attributed to solar activity transitions.

The Solar, Anomalous, Magnetospheric Particle Explorer (SAMPEX) vehicle re-entry is scheduled for mid-October. The satellite, terminated in May 2004, has been operated as an Education and Public

Outreach (EPO) effort at Bowie State University; NASA is hoping to have data until re-entry, to provide some overlap with RBSP data.

Government Performance and Results Act (GPRA) Exercise

Dr. Jeff Newmark, Executive Secretary of HPD, outlined the outcomes and objectives comprising the Government Performance and Results Act (GPRA), which were to be the subject of evaluation by HPS, as measured against NASA's 2010 Science Plan and the FY12 budget. The subcommittee was asked to provide a high-level subjective assessment of science performance, basing their evaluations on the general sense of progress as evidenced by key accomplishments or disappointments for each of the three science objectives. The full language for the science objectives, or Annual Performance Goals, as previously mentioned, are: understanding fundamental physical processes of the space environment from the Sun to the Earth, to other planets, and beyond to the interstellar medium; improving the understanding of how society, technological systems, and the habitability of planets is affected by solar variability interacting with planetary magnetic fields and atmospheres; and maximizing the safety and productivity of human and robotic explorers by developing the capability to predict extreme and dynamic conditions in space. Grades are given as colors by GPRA rating definitions: Green, Yellow, and Red. Dr. Newmark distributed NASA-generated documentation of a number of Heliophysics accomplishments, based on peer-reviewed research, input from NASA discipline scientists, and principal investigators via NASA project scientists, describing major scientific findings and discoveries in Heliophysics over the past year. Fielding a question on the effect of a Continuing Resolution on performance goals, Dr. Newmark confirmed that HPD will have an opportunity to update its annual performance goals if the budget changes appreciably from the President's request.

Dr. Hagan opened the discussion. Dr. Robert McPherron suggested that each member vet the distributed literature within their experiences and choose highlights, as well as to identify gaps and additional ideas, such as the need for an addition of Theory and Modeling advances. Dr. Schrijver suggested closely address fundamental processes; while he felt that LWS was doing a good job in encouraging the interaction of disciplines, efforts are falling short in studies of how the sun impacts technological systems such as the power grid. Effects on human society are generally not being specifically analyzed or addressed in HP research. Dr. McPherron noted that one issue preventing the measurement of societal impacts is the proprietary nature of the data that informs this measurement. Dr. Schrijver agreed, adding that as these data impact both national security and hence society, one is caught in a catch-22 between the release of data and demonstrating its utility, as well as hindered by liability issues with insurers. Dr. Swenson felt that this criticism could be interpreted as mismanagement. Dr. Lika Guhathakurta commented that one future difficulty will be the lack of access to data; perhaps HPS can comment on the data access issue.

Luncheon Talk

Dr. Mona Kessel presented a luncheon talk on the subject of RBSP science.

Working Session

HPS considered the PAR data in terms of prioritization, addition, and re-writing. Consider consulting annual reports from individual grants in Theory and Modeling. Schrijver said these are often proprietary; recommended researching science focus areas for accomplishments.

Research and Analysis (R&A) Status

Dr. Mona Kessel presented an updated status of the HPD Research and Analysis (R&A) program. Solar and Heliophysics (S&H) proposals from the selection for FY10 ROSES (selections not made until 2012) received 175; 30 were selected, representing a 1-in-6 success ratio for a total of \$4.9M. In S&H today, there are 115 current awards at an average funding of \$120K. In the Guest Investigator program (GI), based on the selection for FY2011, there are 50 current awards at an average funding level of \$100K, for a total of \$1.3M. 91 proposals were submitted and 12 were selected, a 1-in-8 success ratio. For the combined Supporting Research and Technology (SR&T), Instrument Development Program (IDP), Low-cost Access to Space (LCAS) and GI program in 2012 ROSES, there were 231 proposals: 151 in SR&T, 20 in LCAS, 16 in IDP and 44 in the GI program. Six million dollars was available under this call, and \$46M was requested (success ratio of 1 in 8). Peer review is ongoing and awards will be made in the Fall. In Geospace, there are 100 current awards with average funding of \$115K. In the Geospace selection for FY11; 149 proposals were submitted, and 29 selected, for a 1-in-5 success ratio and a total of \$4.1M.

Under the LWS Targeted Research and Technology (TR&T) program for FY10, 146 proposals were submitted and 44 selected, for a total of \$4.7M. For TR&T in FY11, 203 proposals were submitted, and HPD expects 42 selections for a total of \$7M. There are 3 focus teams in TR&T, including sun-climate themes and a joint collaboration with NSF Space Weather. Dr. Kessel noted that Step 1 and Step 2 proposals are being used in this most recent SR&T selection process; in most cases, 10-20% of Step 1-proposers did not propose a Step 2. Asked if there had been any duplicative proposals in the two-step process, Dr. Kessel reported that there had been some submissions of LWS-like proposals to Geospace, but felt that the descriptions were fairly effective in weeding out most noncompliant proposals. This does not however presage a permanent changeover to a two-step proposal format in the SR&T program. Dr. Schrijver commented that researchers are spending a lot of time writing proposals, representing a hidden cost at this low level of funding; consequently the big questions supported by big funding are not getting asked; this is setting up the system for small problems, with slow turnaround and small projects. The community is looking for an equivalent of strategic missions and Explorers in the R&A program. Dr. Guhathakurta commented that LWS accomplishes this through its strategic capabilities. Dr. Giles noted that strategic studies can be done within the procurement mechanism, however HPD would need guidance from the community on how to do this. The review can be structured to handle whatever proposals come in, and the procurements would be open to whatever the community proposes. Dr. Schrijver felt that researchers put themselves at a disadvantage when proposing high-dollar-value missions. Dr. Giles assured HPS that every proposal is assessed on its own merits to an absolute standard. Dr. Ennio Sanchez remarked that in the past HPS had made specific suggestions as to how large and how lengthy awards should be, and felt it worthwhile to take these recommendations one step further; he also recommended having new subcommittee members read the previous findings so as to carry forward past

recommendations. Regarding proposal considerations of cost, it was noted that within LWS, panelists do in practice consider the “science per full-time equivalent (FTE)” when evaluating proposals.

Senior Review of Operating Missions

Dr. Jeffrey Hayes, Program Executive for Mission Operations and Data Analysis (MO&DA), provided a preview of the upcoming Senior Review. MO&DA includes the GI program, data and modeling services for the Virtual Observatories (VxOs), and multi-mission operations at Goddard Space Flight Center (GSFC), and concentrates on control center functions and flight dynamics, sustaining operations infrastructure, all space operations at GSFC, etc. The Senior Review (SR) is a comparative review that aims to maximize the scientific return from missions and programs while operating within finite resources. NASA uses the findings from these comparative reviews to define an implementation strategy and give programmatic direction to missions and projects for two to four years. As the SR is considered a procurement, the rules for conflicts of interest are applicable to SR panel members.

SRs often recommend mission extensions (EMs) to take advantage of heritage that has been calibrated, yielding better efficiencies, and which can continue missions for about 2/3 of the original operating cost. EMs can be as simple as bare-bones data handling, including low-level processing and basic archiving; minimal science data analysis to maintain understanding of instrument performance, etc. The charge to the SR panel is to rank the missions in terms of their “science per dollar” values. Scientific merits include relevancy to HP research objectives and focus areas, scientific impact, and promise of future scientific impact. The 2013 SR results will influence the FY14-15 budgets. Proposals for the SR will ask for a demonstration of ties into the 2009 Heliophysics Roadmap and 2010 NASA Science Plan; broad accessibility and usability of data, and an assessment of spacecraft and instrument health. In format, the proposal will contain a science section, a technical/budget section, a mandatory description of the intended associated E/PO project (no more than 1% of mission), legacy science data archiving and migration plan to a final archive, and a budget spreadsheet. The review will make the best effort to consider the outcome of the 2013-2022 Decadal Survey.

A draft call will be issued in October, with proposals due in early Spring. The proposals will discuss each mission’s potential for elucidating science answers during FY13-18. Dr. Schrijver asked what type of guidelines defined the future productivity of science teams. Dr. Hayes explained that the SR attempts to formulate a more rigorous way of mapping the expected science outcomes of extended missions. Dr. Schrijver expressed concern about the ambiguity of language governing a proposal concept that translates to: what are you going to do with money you’re not going to get? Dr. Hayes replied that work is being done to clarify these guidelines. Dr. Giles noted that when proposing for an EM, a proposer can also try to imagine what more the mission can contribute to the community, and agreed that HPD could provide clearer language on how to do this. There are two grades assigned to the proposal, one evaluating the mission itself as well as its contribution to the System Observatory; the science return can be and is generally enhanced by leveraging resources from assets outside of the mission.

SR proposals are due in early February, the panel meets in April, and the final report will be released in June 2013. In late June HPD will consult with HPS and international partners on the outcome of the

review. Missions will then have 60 days to respond with plans to meet new guidance and instructions; i.e. by the beginning of the new fiscal year. NASA is trying to improve accountability and traceability in the process. Dr. Swenson recommended selecting the panel as early as possible and sending the proposals to the panel as soon as they come in, and that it hold at least one telecom before the first face-to-face meeting. He further suggested evaluating the concept of the scientific value of the mission relative to what it costs, not science per dollar. What is the scientific value of collecting data in an EM, for instance? Asked if all continued missions would have a GI program, Dr. Hayes replied that a Participating Scientist would become a part of the team, as has been done in the past with the CINDI and Voyager missions. SDO, however, does not have a GI program, despite their having been SDO GI proposals. In terms of a preference for systems-level versus individual proposals, Dr. Swenson strongly suggested using spacecraft as part of the System Observatory.

Sounding Rocket Program

Dr. Cheryl Yuhas discussed the FY12 suborbital missions under the Sounding Rockets program. Heliophysics has launched the CHAMPS, MICA, ATREX, and SDO/EVE calibration missions from a number of locations, including Andoya, Norway, Poker Flats and Wallops. Upcoming rockets include EVEX, to be launched at Kwajalein, and SUMI, HI-C, and DFS at White Sands Missile Range (WSMR). Other suborbital missions are Gamma Ray Imager/Polarimeter for Solar Physics (GRIPS) and BARREL, which is on track for Antarctic deployment in the Fall. The program just completed a year-long stand-down at WSMR due to lack of flight termination systems; this year HPD is trying to catch up, but have only managed one launch thus far, as PIs have not been prepared, generally. Missing a launch slot makes it difficult to obtain other opportunities. Dr. Yuhas provided some photos of the Anomalous Transport Rocket Experiment (ATREX) mission, comprised of 5 rockets launched in 5 minutes, creating multiple downrange clouds for the purpose of studying high-altitude wind patterns.

Launch facilities at WSMR have recently obtained long-needed upgrades, a new integration laboratory is up and running, and two solar missions presently in integration at the site. The Poker Flats research range-environmental impact statement, which could have potentially banned NASA launches, has now been resolved. NASA worked with the US Fish and Wildlife Service and the Bureau of Land Management, and eventually came to an agreement that NASA would be grandfathered in to the program; the range now stands ready to support a mission this winter. At the Reagan Test Site at Kwajalein Island, there have been some range scheduling problems, which may push a delay to one year. At the Woomera test range in Australia, NASA has been discussing a launch site plan for a 2014/15 campaign, which currently appears feasible.

Rocket motor status

Terrier-Improved Malemute rocket motors have been added to the inventory, and were in fact used for the recent ATREX mission. Six Oriole motors have also been added to the inventory to provide a back-up to the Brant motor. Not every Brant payload can transition to the Oriole payload, however. The first use of the Terrier-Improved Malemute motor demonstrated some residual thrust, creating a potential for the motor to overtake the payload in some configurations. A test flight of a Talus-Terrier-Oriole configuration will take place this summer. Brant motors are in flight-status, but technical issues remain. Casing test failures, unusual dynamics, and combustion instability have been persistent issues. The

casings issue has been resolved, the combustion issue has been mitigated and is under watch, and the unusual dynamics problem remains unresolved. Combustion instability presents a safety issue with respect to flight termination systems (FTS). Flight rules allow FTS initiation at the first sign of instability. The first flight of the Black Brant Mk2 Version 1 Motor seems to have addressed both combustion and dynamics issues in a promising manner. There are 14 Black Brant motors currently in stock; they are a mixture of provenance; three motors cannot be flown at WSMR due to high-end burn rates. The program is also trying to solve a NiCad battery supply issue.

Peregrine motor development is an in-house project, the objective of which is to produce a reliable alternative to the Brant and Oriole motors. The project is employing engineers at Marshall Space Flight Center (MSFC), as well as a collaboration between the Office of the Chief Engineer (OCE) and the Office of the Chief Technologist (OCT). OCT will create payloads for test flights on an 18-month development schedule that began in March 2012. The first test flight is scheduled for summer 2013, and HPD is evaluating proposals on casings and castings at present, and is trying to duplicate the original specifications for Brant performance.

Heliophysics 2012 MiniRoadmap: Aligning the Decadal Strategy for Solar and Space Physics with NASA Heliophysics

Dr. Newmark reviewed the structure of strategic planning with respect to the emerging 2013-2022 NRC Decadal Survey (DS) for Solar and Space Physics. A new NASA Strategic Plan is due in 2014, and a Science Mission Directorate (SMD) Science Plan shortly afterward; these documents will be a timely input along with the DS, which will provide compelling targets, science challenges, and a critical overview of disciplines. A slightly revised Heliophysics Roadmap 2012 will help align the DS science strategy with HPD, craft a sustainable science program within the NASA resource constraints, and construct a useful strategic plan with a notional scheme to guide implementation of critical science in HPD. The new roadmap is envisioned as a streamlined document containing high-level mission studies and no point designs. The high-level concepts are derived from Roadmap 2006, which followed the previous DS very closely; for 2009, under more severe budget conditions, the Roadmap recommended competing mission designs, with cost caps. For science objectives, the Roadmap considered the influence of the DS by canvassing the community through a top-down exercise, to consider what scientific tasks could be carried out to address the DS objectives within reduced resources. Dr. James Spann added that NASA evaluated what was being done to meet DS objectives and what still needed to be done, staying within the funding wedge provided to the Agency. The final Roadmap will be a product of the HPS, created by a subpanel, which will then be considered at the NASA Advisory Council (NAC) Science Committee, and the NAC itself.

The Roadmap will focus on aligning the strategy developed by the DS with the HP program over the next ten years, and to extend the strategy out to 2033, including identification of needed technology development and the provision of a flexible mission implementation approach. A kickoff telecom is scheduled for early July, and the first panel meeting will occur some number of weeks after the DS release, followed by a Red Team review in November, and Roadmap rollout in December 2012. The

schedule will be adjusted as necessary. Instead of another workshop, NASA is proposing to solicit quad charts from DS white papers and ideas from the general community through newsletters.

July 3, 2012

NASA Space Weather Program (NSWP)

Dr. Bill Stabnow presented a status by telecom on the NASA Space Weather Program (NSWP), first presenting a brief history of how the office was created from the Federal Meteorological Coordinating Infrastructure. The multi-agency National Space Weather Council oversees the Committee for Aviation Services and Research. NASA, NSF, the USAF and others have responsibility for space weather under these councils and committees. Other key agencies include the Departments of Transportation and the Interior. The charter for NASA states that SMD and the Human Exploration and Operations Mission Directorate (HEOMD) hold the main responsibilities for Space Weather. The NASA Space Weather team consists of HEOMD, OCE, the Office of International and Interagency Relations (OIIR), the SMD Associate Administrator, and the HPD Division Director and is supported by bimonthly meetings to discuss the various aspects of space weather, from international to internal. Applications of HP, led in part from the HP Roadmap 2009, and beacons from NASA spacecraft, contribute overall to space weather (SW) monitoring. The Applied Heliophysics program provides SW beacon services, research-to-operations activities, inter- and intra-agency coordination, and space environment services, with NASA's Community Coordinated Modeling Center (CCMC). Useful websites include those maintained by the National Space Weather Program; Space Weather Prediction Center (NOAA); the National Space Weather Program; CCMC; Air Force Weather Observer; Air Force Weather Agency; Integrated Space Weather Analysis System (iSWA); Space Weather Enterprise Forum; International Space Weather Initiative; United Nations Office for Outer Space Affairs; and the Space Radiation Analysis Group at Johnson Space Center. References include the Unified National Space Weather Capability (UNSWC) memorandum of understanding (MOU) (NOAA, NASA, NSF, AF, USGS) and its ANNEX#1, both of which are in signature cycle at present; the HPD Roadmap 2009; the NSWP Strategic Plan 2010/1995; and a NSWP Implementation Plan. Dr. Judith Karpen requested a list of members of committee on the Space Weather Council; Dr. Stabnow agreed to route this list through the Executive Secretary. Asked to describe the Unified National Space Weather Capability, Dr. Stabnow noted that while the effort is still subject to the draft level-MOU Annex, the capability promises to explore the opportunity to transition research models to an operational agency, leveraging existing resources through a largely volunteered effort. Dr. Spann added that further annexes will be provided among the five agencies for specific tasks; the first annex is focused on transitioning some geospace models to NOAA. He anticipated several other annexes as more tasks are identified. Dr. Giles remarked that the purpose of the MOU is to consolidate past cooperation, which had previously been taking place on the margins of programs. This is a new step in formalizing cooperative efforts in the future to create a national space weather capability. Formalization implies a commitment to carry out tasked actions; this creates targets for OMB and OSTP. If there is no written agreement, there is a weaker commitment. Dr. Schrijver felt the MOU offered no clear view to substantial partnerships with agencies; and no validation of these research models from CCMC, implying that the models are not ready for forecasting. Dr. Giles noted that the first task is to illustrate current capabilities in a report; this is a valuable asset to have in the community, allowing open discussion. A good first step will be the collection of information about the distribution and placement of

space beacon data. Dr. Giles felt that HPS could play a useful role in determining what needs to happen to transition models to operations, an aspect of which is to how to bring the industry component into predictive models. Dr. Stabnow added that two key agencies, the Department of State and Homeland Security, are also included in this cooperative effort. Dr. Karpen asked how focus areas in LWS might address space weather. Dr. Giles described LWS as a research program directed to those items important to life and society, but not to the operational side; however some LWS research could provide candidates for transition to operations, over time. Evaluation of models is ongoing and would be a first test in the transition process. Asked how models are determined to be ready to be tested and transitioned, Dr. Giles explained that in this latest case involving the MOU, NOAA chose five models and worked with CCMC to determine what types of tests were necessary to evaluate whether they were suitable- one model was transitioned last year, and one or two more are expected to be transitioned next year, on the basis of some small funding lines. Dr. Swenson remarked that while one can create a model, the model needs real data to drive it; he asked what sort of data was of interest to the operational community. Dr. Giles felt that question was not answerable at present. Dr. Karpen stressed that the community must be involved to guide model validation and testing; NASA can't leave the impression that the community is being ignored or circumvented. Dr. Giles noted that the MOU defines what will happen, but not how NASA will go about it, allowing practitioners to carry out tasks within the community vetting process; the intent is to ensure that the implementation is in the hands of the practitioners. Dr. McPherron commented that he was finding it impossible to penetrate the system, particularly in terms of offering an empirical model to NOAA; there appears to be no way of obtaining resources or making models accessible. Dr. Arik Posner suggested that the community provide objective metrics to help assess NASA progress in space weather.

GPRA work session continued

Prioritized highlights and voting

Objective 2.2.1 Annual Performance Goal (APG) HE-12-1 Fundamental processes

- Voyager and IBEX probe our heliosphere's interaction with the local galactic and interstellar medium
- Long-term changes and trends in the ITM and stratosphere
- Coronal electron temperature in the deep solar minimum and throughout the space age & origin of slow solar wind
- NASA researchers working with the Aeronomy of Ice in the Mesosphere (AIM) satellite have discovered that the highest clouds in the Earth's atmosphere form around meteoric smoke molecules and the ozone hole
- The lunar precursor region: how the solar wind "senses" the Moon

Vote: 9/unanimous for Green

2.2.2 APG HE-12-4 Impact on Society/Technology

- Discovery of energetic late phase emissions from many solar flares
- Modeling and tracking of multiple CMEs observed with the Heliophysics Systems Observatory
- NASA spacecraft provides global perspective of geomagnetic disturbances
- HSO provides new insights in the acceleration of energetic solar particles
- TWINS uncovers striking new details of the solar-minimum terrestrial geocorona

Vote: 9/unanimous for Green

APG HE-12-5 2.2.3 Demonstrate planned progress in maximizing the safety and productivity of human and robotic explorers

Advanced detection of submerged sunspots

- Unraveling the mystery of disappearing radiation belt electrons and charged particles
- TWINS stereo imaging reveal new global structures in the terrestrial ring current
- SDO and STEREO spot something new on the Sun (unraveling the magnetic structure)

Vote: 9/unanimous for Green

Discussion

HPS reviewed some images in the PAR, and discussed the opportunities and risks associated with the FY12 Science Performance Assessment document. Dr. Schrijver noted that risk as written focuses on expendable launch vehicles (ELVs), and added that spacecrafts themselves are also becoming more expensive. Explorers are not launching frequently enough. He suggested including a comment about the increasing cost of spacecraft, which in turn is affecting the ability to rapidly respond to upcoming opportunities. Requirements, tests, and documentation are driving up cost of spacecraft (some PIs say the costs have doubled); this cost escalation might be worth looking into. Explorers by definition were to be rapid and relatively high risk. Dr. Schrijver also suggested providing a clearer picture of how the Heliophysics System Observatory protects the infrastructure, and a better understanding of how LWS is protecting society. Dr. Hagan felt these issues were probably not appropriate for the PAR, but indeed for an HPS finding. Dr. Karpen raised another risk, that of flat funding for R&A and concomitantly lower success rates; a vibrant community stands to lose people. Erosion of the community presents a risk to achieving long-term outcomes as defined in the PAR. Dr. Hagan felt that one can't only point the finger at NASA. Dr. McPherron agreed that the research issue is also a university problem. Dr. Schrijver commented that something has shifted, as the researchers seem to be spending too much time writing and reviewing proposals. Dr. Hagan requested further discussion before including such issues in the PAR. Dr. Newmark noted that both NASA and Congress have been pushing for small commercial firms to produce launch vehicles- if these small firms are successful in future launch opportunities, NASA can take

advantage of their success. Dr. Swenson noted that SpaceX discontinued smaller vehicles because there was no market for them; the company moved to focusing on larger vehicles because it could not keep the smaller product line alive in response to a relatively small demand from HPD. Dr. Schrijver, referring to PI-led Small Explorer missions (SMEXes), asked if there were any way to persuade industries to be interested in accepting some risk to their budget. Dr. Giles said this is a data buy as opposed to a mission buy; NASA has not done this but other agencies have. Dr. Desai commented that spacecraft and mission costs are internal to NASA; imposing the same kind of quality assurance requirements on Flagship missions and Explorers makes no sense. Dr. Giles suggested that the NASA Launch Services program brief HPS at the next meeting; the program includes services that are not provided by commercial rocket suppliers (range/safety, communications, etc.), accounting for the differences in cost profiles associated with launch vehicles. Dr. Schrijver requested a briefing on the HPD research funding profile, in actual dollar figures and in trending over a decade, to understand why R&A changes have transpired in the way they have.

Dr. Hagan agreed to collect final edits and revisions to the PAR.

Findings Discussion

Dr. Swenson commented that he has received feedback from the community, highlighting concerns about submitting proposals to the LCAS program regarding CubeSats; there is confusion about what type of support would be provided by the Wallops Island facility. HPD needs to clarify the level of understanding in the ROSES call. Dr. Swenson also suggested that HPD streamline the use of CubeSats as elements of LCAS, perhaps by engendering discussions between NSF and NASA on how to pull together a call. Such an effort could eliminate duplication of effort by appropriately scoping calls, or by issuing joint solicitations. Dr. Giles noted that the review criteria are completely different, and that moreover the two agencies have different intents. Geospace has science criteria, Solar and Heliophysics also includes training and technology as well as science. Dr. Newmark noted that the Wallops facility does not currently support CubeSat launches in same manner as it does the Suborbital program. Dr. Swenson felt that at the very least, Wallops should offer range support for CubeSats, adding that NSF makes use of an interagency agreement to support CubeSats at Wallops to a certain level, such as providing range and frequency support, and perhaps telemetry. Dr. Sanchez commented that the issue was not ready for a finding. HPS agreed that HPD explore these issues with NSF and NASA and discuss its findings at the next meeting, and to place the consideration in the subcommittee letter. Dr. Newmark agreed to explore the issue further with an eye to discussion at the next meeting.

Dr. Schrijver offered a finding declaring that LWS is ready to embark on studies to demonstrate how space weather impacts society, in conditions ranging from benign to severe space weather. He further recommended growing a research program that looks into societal and technological impacts on critical infrastructures. Dr. Hughes felt that NOAA would be the proper agency for this type of research through the Space Weather Prediction Center (SWPC). Dr. Hagan commented that such an effort would require true interdisciplinary work between social science and space weather disciplines. Dr. Giles suggested that if HPS were advocating for an interagency program, it must also offer ideas on what funds might be diverted from HPD missions to “grow a research program.” Dr. Schrijver argued to create the setting for

this research program within LWS. Dr. Desai recommended using the space weather effort as a template, and to pursue other avenues should the template prove inadequate. Dr. Schrijver suggested using a methodology used by the Centers for Disease Control (CDC) to track data without referring to individuals, which might be used to obtain commercial data without violating confidentiality. Dr. Hagan requested a discussion on research-to-operations issues within the NOAA/NASA MOU, vis-à-vis the CMCC, and a briefing from the Chief Scientist at the next HPS meeting. Dr. Schrijver requested draft copies of Roadmap well before the next meeting. Dr. Strachan recommended a discussion on the budget, insofar as practicable.

Dr. Giles thanked the committee for its hard work. Dr. Hagan adjourned the meeting at 3:10 pm.

Appendix A Attendees

Heliophysics Subcommittee members

Maura Hagan, Chair, National Center for Atmospheric Research

Mihir Desai, Southwest Research Institute

Jeffrey Hughes, Boston University

Judith Karpen, NASA Goddard Space Flight Center

Robert McPherron, University of California

Ennio Sanchez, SRI International

Karel Schrijver, Lockheed Martin

Leonard Strachan, Harvard Smithsonian Center for Astrophysics

Charles Swenson, Utah State University

Jeffrey Newmark, NASA HQ, Executive Secretary

NASA Attendees

Marc Allen, NASA SMD

Gaye Albright, NASA HQ

Victoria Elsbernd, NASA HQ

ElSayed Falaat, NASA HQ

Barbara Giles, Director HPD, NASA HQ

Lika Guhathakurta, NASA HQ

Jeffrey Hayes, NASA HQ

Jennifer Kearns, NASA SMD

Mona Kessel, NASA HQ

John Lee, NASA HQ

Jeff Newmark, NASA HQ

Marian Norris, NASA HQ

David Pierce, NASA HQ

Arik Posner, NASA HQ

Diego Sanchez, NASA HQ

James Spann, NASA HQ

Beth Weinstein, NASA HQ

Cheryl Yuhas, NASA HQ

Other Attendees

Dom Conte, Orbital Sciences

Tiffany Walden, Medill News Service

Joan Zimmermann, Zantech IT

Appendix B
Subcommittee Membership

Maura Hagan (Chair)

National Center for Atmospheric Research
Boulder, CO

Jeffrey Hughes
Astronomy Department
Boston University

Judith Karpen
NASA Goddard Space Flight Center

Robert McPherron
Institute of Geophysics and Planetary Physics
University of California at Los Angeles

Ennio Sanchez
SRI International

Karel Schrijver
Principal Physicist
Solar and Astrophysics Laboratory

Leonard Strachan
Harvard-Smithsonian Center for Astrophysics

Charles Swenson
Center for Space Engineering
Utah State University

Jeffrey Newmark
Executive Secretary HPS
NASA Headquarters

Marion Norris
Ms. Marian R. Norris
Management Support Specialist
Science Mission Directorate
NASA Headquarters

NAC Heliophysics Meeting Minutes, July 2-3, 2012

Appendix C Presentations

1. Heliophysics Division Status; *Barbara Giles*
2. Heliophysics Division Flight Program Status; *Victoria Elsbernd*
3. FY12 Heliophysics Science Performance Assessment; *Jeffrey Newmark*
4. Heliophysics Division Research and Analysis Status; *Mona Kessel*
5. Senior Review of Operating Missions; *Jeffrey Hayes*
6. Sounding Rockets Program and Peregrine Motor Development; *Cheryl Yuhas*
7. Heliophysics Decadal Survey and Roadmap; *Jeffrey Newmark*

Appendix D
Heliophysics Subcommittee Meeting
July 2-3, 2012
MIC-6 (Room 6H45)

Monday, July 2

8:30 Subcommittee Room Open

9:00 Welcome, overview of agenda, introduction of new members Maura Hagan, HPS
Chair

9:15 Heliophysics Division Overview Barbara Giles, NASA HQ

10:00 Flight Program Status Victoria Elsbernd, NASA HQ

10:15 BREAK

10:30 Heliophysics Science Performance Assessment Jeffrey Newmark, NASA HQ

Input the FY2012 NASA PAR – Overview

11:00 Heliophysics Science Performance Assessment, input for Subcommittee
the FY2012 NASA PAR – Review and Assignments

12:30 LUNCH IN ROOM: Mona Kessel NASA HQ: Science of RBSP

1:30 Subcommittee work session(s) Subcommittee

3:00 BREAK

3:15 R&A Status:	Mona Kessel, NASA HQ
3:30 Senior Review of Operating Missions	Jeff Hayes, NASA HQ
4:30 Sounding Rocket Program and Peregrine motor Development	Cheryl Yuhas, NASA HQ
4:45 Heliophysics Decadal Survey and Roadmap	Jeff Newmark, NASA HQ
5:00 END OF DAY	

Heliophysics Subcommittee Meeting

July 2-3, 2012

MIC-6 (Room 6H45)

Tuesday, July 3

8:30 Subcommittee Room Open

9:00 HPD Space Weather Related Activities

Bill Stabnow, NASA HQ

9:30 Heliophysics Science Performance Assessment, input for Subcommittee
Subcommittee the FY2012 NASA PAR – Final Work and Voting

10:15 BREAK

10:30 Heliophysics Science Performance Assessment, input for Subcommittee
Subcommittee the FY2012 NASA PAR – Final Work and Voting Continued

12:00 LUNCH

1:00 Discussion, including future meeting dates, potential agenda topics, action items	Subcommittee
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3:00 BREAK

3:15 Subcommittee work session(s)	Subcommittee
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4:00 Debrief with the Heliophysics Division Director	Barbara Giles, NASA HQ
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5:00 ADJOURN